UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Survey of helium in natural water wells and springs in southwest Montana and vicinity

Part II - July 1 - Dec. 31, 1979

By

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Open-File Report 80-1257

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards.

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This report is a continuation of the work on a helium survey presented in Open-File Report 80-181, which covered the period Sept., 1977 - June 30, 1979. Water samples were analyzed for helium collected from twelve springs and wells, of which four are new locations. A brief description of these stations is given in Table 1 and their location is shown on the map of Figure 1. Two springs (303 and 304) previously reported on do not appear in this report. Station 306 was discontinued after August 11.

The samples were collected and analyzed by the same methods as previously reported. The helium content shown in Figures 2-13 is that above the helium in ambient air, which is 5.24 parts per million. Note that the data for stations 300, 317, and 318 are given in ppm/ml, while the rest are in ppb/ml. This refers to helium concentrations per millileter of water in each sample. Julian calendar dates as shown in these figures can be converted to Gregorian dates (see Fig. 14). We believe that changes of more than $\pm$ 10 percent of the amount of helium present are significant. However, such large changes may be due to sampling problems, rather than to true changes in helium in the aquifer. We feel that the relatively large changes in helium abundance in station 300 in early 1979 were due to sampling difficulties. The occasional large spikes shown in Figure 2 might be accounted for by the accumulation of gas in the sampling system between sampling times. Additional flushing of the system before taking a sample appears to have rectified the problem after day 262 (Sept. 19). There were no large or permanent changes in the helium content from any of the stations. There were only two earthquakes reported in the area under study during the reporting period. The National Earthquake Information

Service reported a 3.8 Richter scale magnitude quake in the vicinity of Great Falls, Montana on August 9 (Julian 221) and one of 3.1 magnitude near Three Forks, Montana on November 30 (Julian 334). Since there was no great earthquake activity during this six-month period there was no opportunity to study the relationship of earthquakes to changes in helium content.

Another report will be issued covering the results of future work of this project.

Table 1.--Localities of helium-sampling stations

Station No.	Station Name	Address	Comments
300	Miller	Dick Miller River Route Box 17 Gardiner, Montana 59030	58.5 m (192 ft) deep; well pump at 50.3 m (165 ft) pumped continuously at 7.6 lpm (2 gpm); water temp. 67°C, (153° F). This well is about 300 m (984 ft) from a small warm spring, and 1000 m (3281 ft) from La Duke Hot Springs, a large hot spring. The water is high in fluorine and iron.
301	Beer	U.S.G.S. Box 1049 West Yellowstone, Montana 59758	This well is 61 m (200 ft) deep and is a water source for service facility at Yellowstone National Park entrance.
305	McAtee	Leonard McAtee Cameron, Montana 59720	61 m (200 ft) deep; domestic water supply.
306	Beartrap	Mike Zankowsky P. O. Box 24 Norris, Montana 59745	Large hot pool used for bathing.
308	Lapp	Allen L. Lapp Box 503 West Yellowstone, Montana 59758	Town well, 67.7 m (222 ft) deep; cased to 45.7 m (150 ft).
309	Povah	Pat Povah Deep Well Ranch West Yellowstone, Montana 59758	274 m (900 ft) well, artesian flow with 1.8 m (6 ft) head.
310	Chico	Mrs. Jean Weeter Pray, Montana 59065	Hot spring.
311	Todd	Mrs. Larry Todd Emigrant, Montana 59027	This well is 45.7 m (150 ft) deep; fully cased; 45.5-58.6 lpm (12-15 gpm); water temp. is 10°C (50°F).
312	Bathtub	Paul Miller River Route, Box 17 Gardiner, Montana 59030	Large warm pool at top of Mammoth Hot Springs; Yellowstone National Park.
313	Orr	Wesley Orr Ennis National Fish Hatchery Ennis, Montana 59729	Flowing Spring; 1515 lpm (400 gpm); water temp. is 12°C (54°F).
317	Pray	Mrs. Steve Pray Ennis, Montana 59729	Domestic well, 42.7 m (140 ft) deep; water contains H_2S; temp. is 51°C (124°F).
318	Thexton	Mrs. Liz Kielley P. O. Box 627 Ennis, Montana 59729	Ennis Hot Springs; water temp is 84°C (184°F).

REFERENCES

Doering, W. P. and Friedman, I., 1980, Survey of helium in natural water wells and springs in southwest Montana and vicinity: U. S. Geological Survey Open-File Report 80-181, 42 p.

Preliminary determination of epicenters, August and November, 1979: U. S. Geological Survey National Earthquake Information Service, 14 and 13 p.

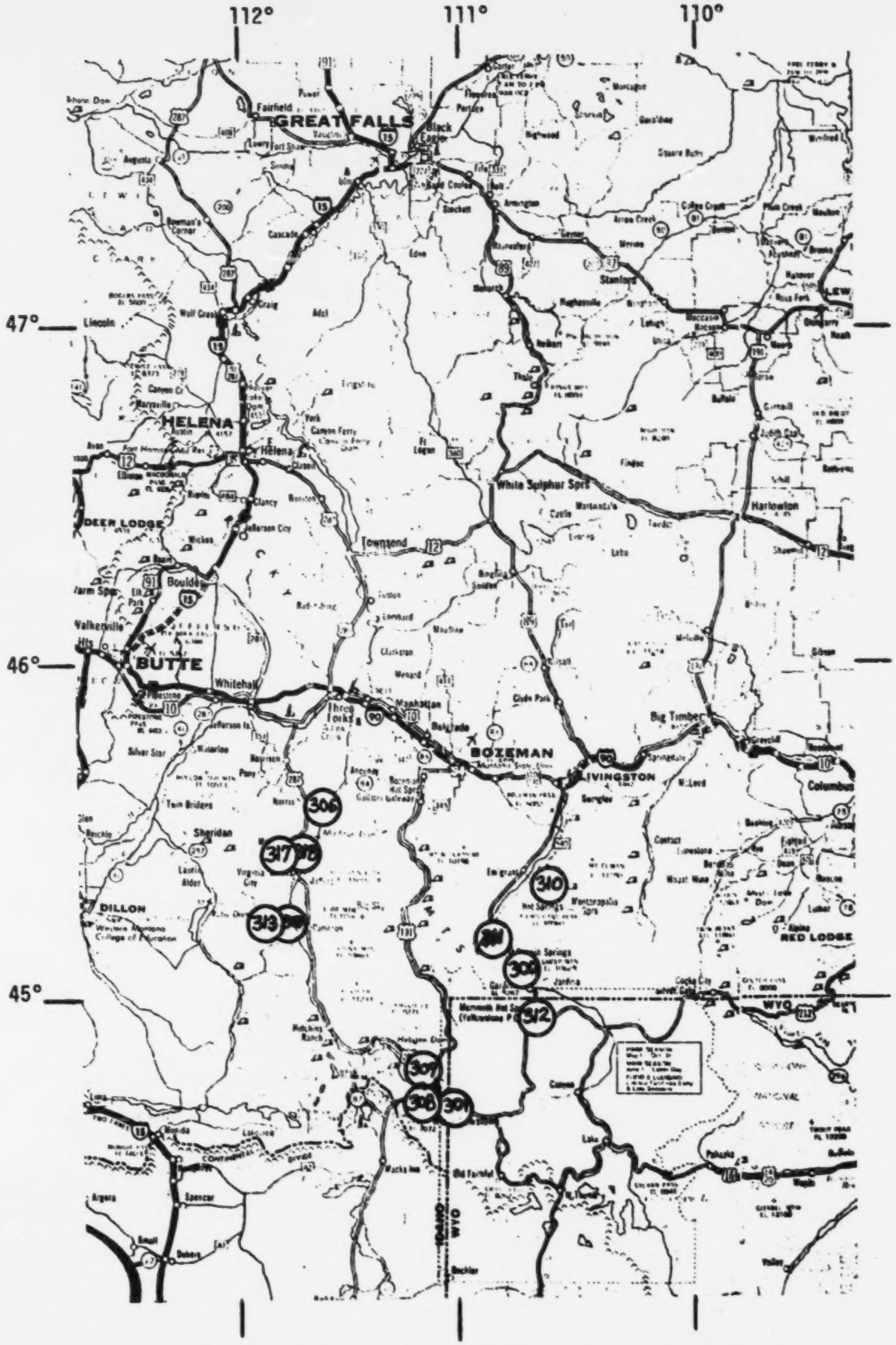

Figure 1.--Helium sampling stations (shown by number). Scale approximately 1:1,789,000 (1 inch to 28.2 miles).

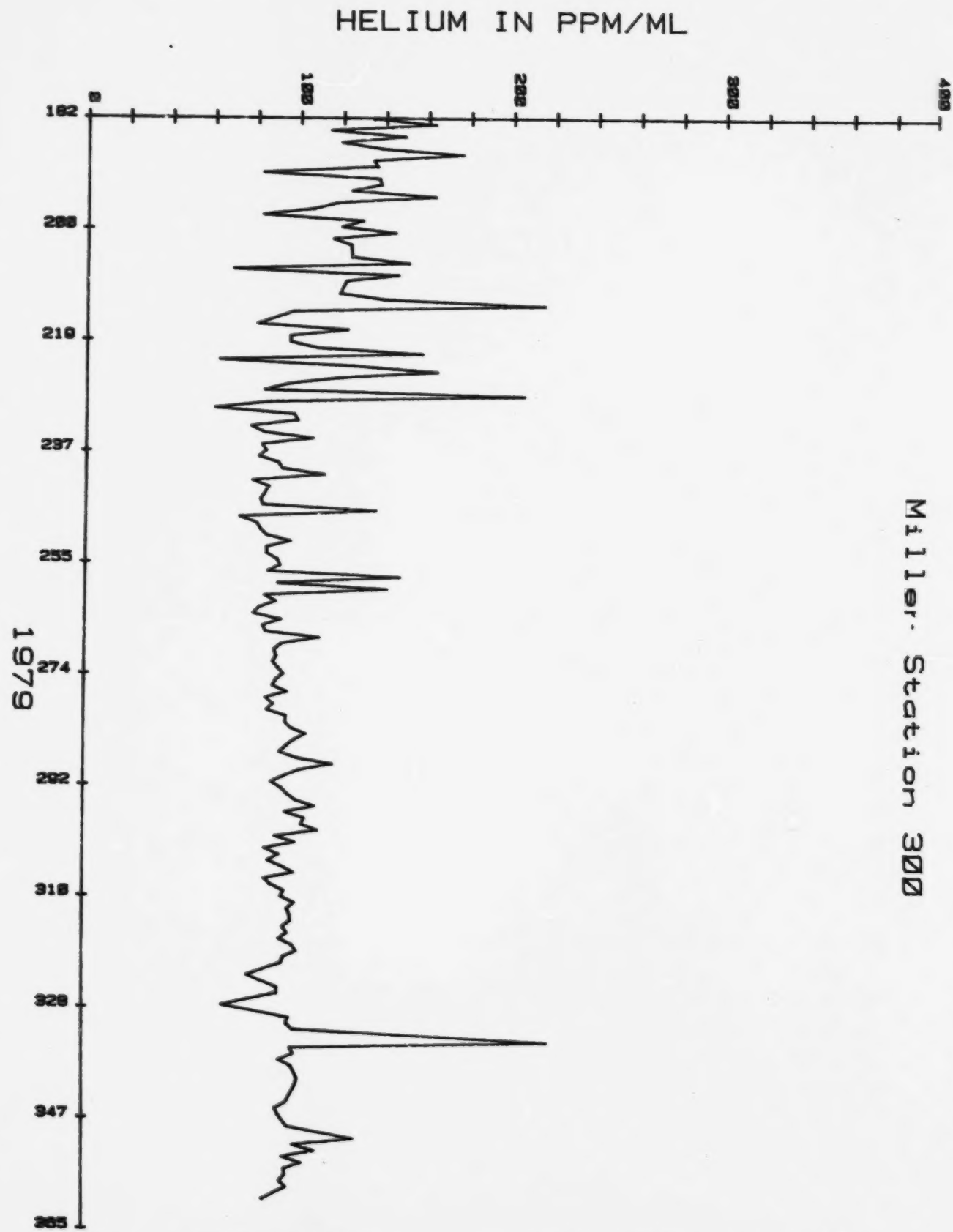

Figure 2.--Helium concentrations in water samples, Gardiner, Montana, July through December, 1979.

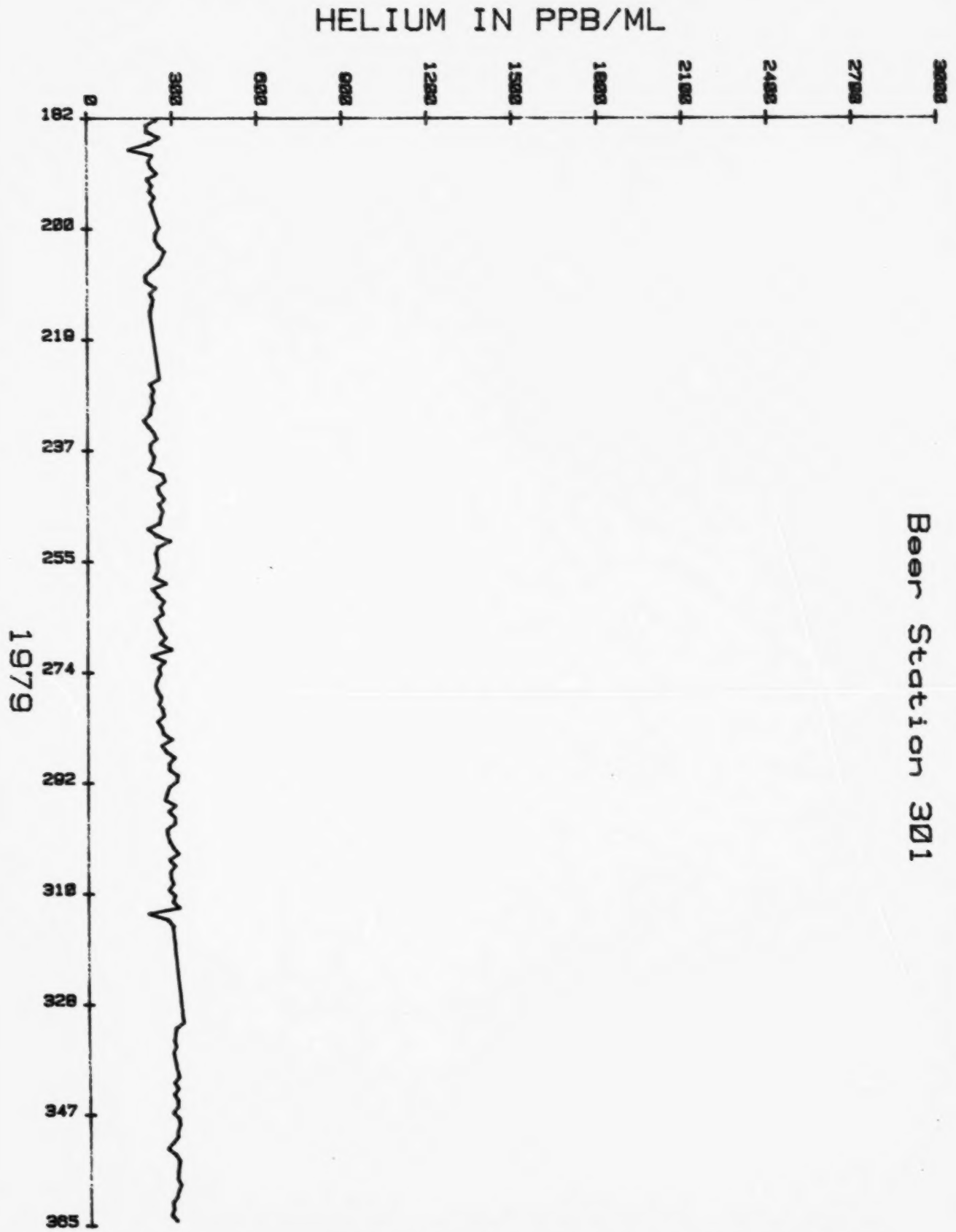

Figure 3.--Helium concentrations in water samples, West Yellowstone, Montana, July through December, 1979.

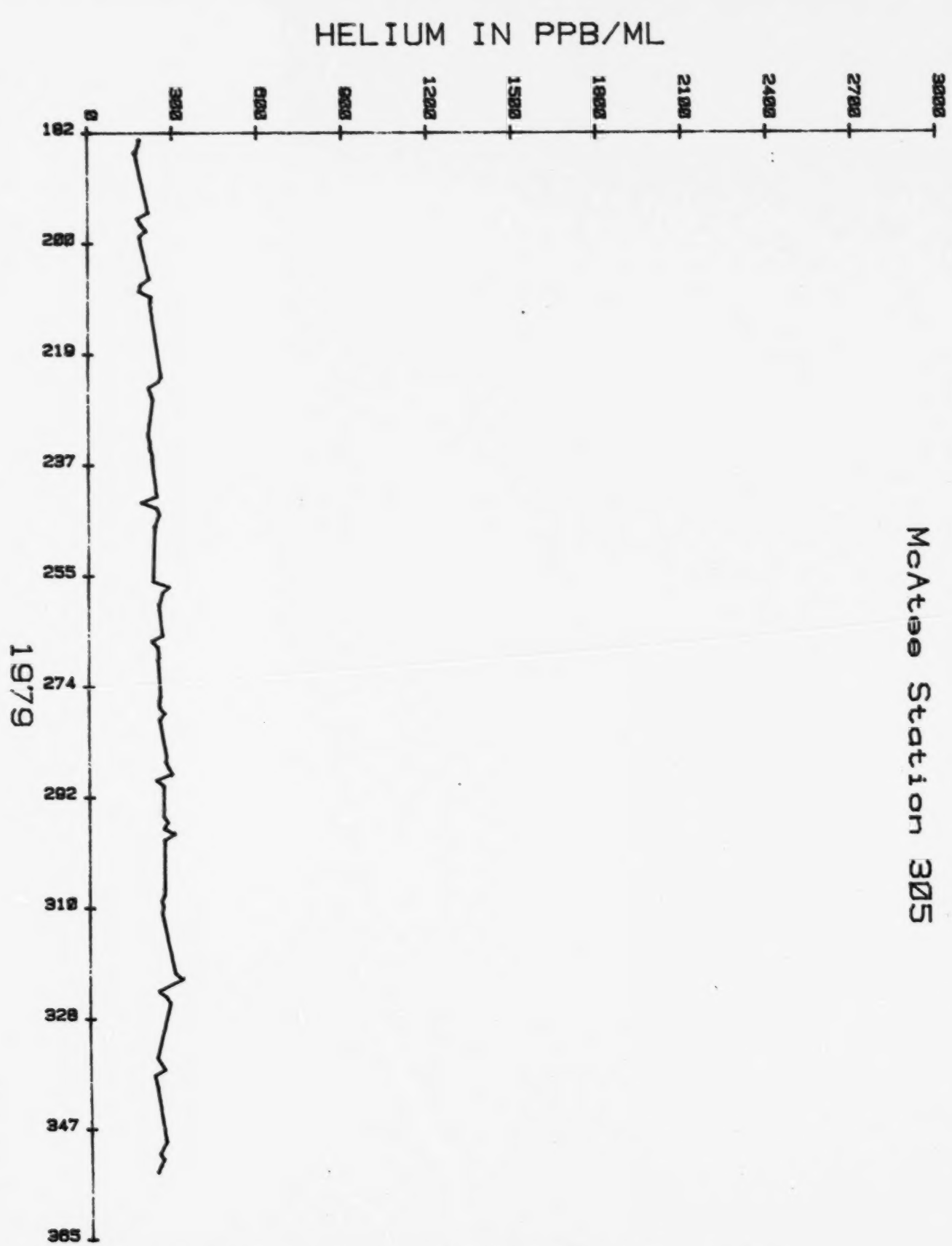

Figure 4.--Helium concentrations in water samples, Cameron, Montana, July through December, 1979.

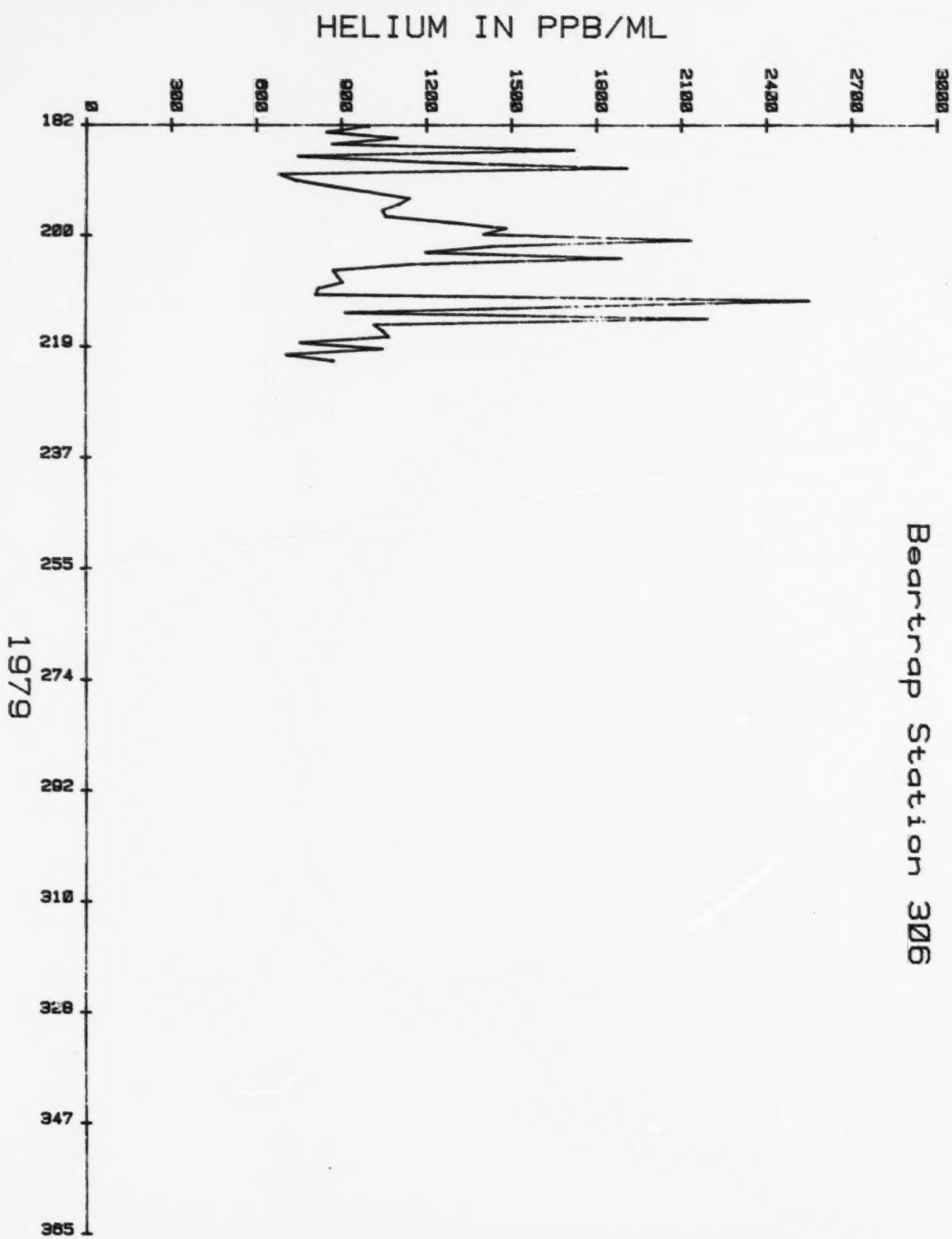

Figure 5.--Helium concentrations in water samples, Norris, Montana, July through December, 1979.

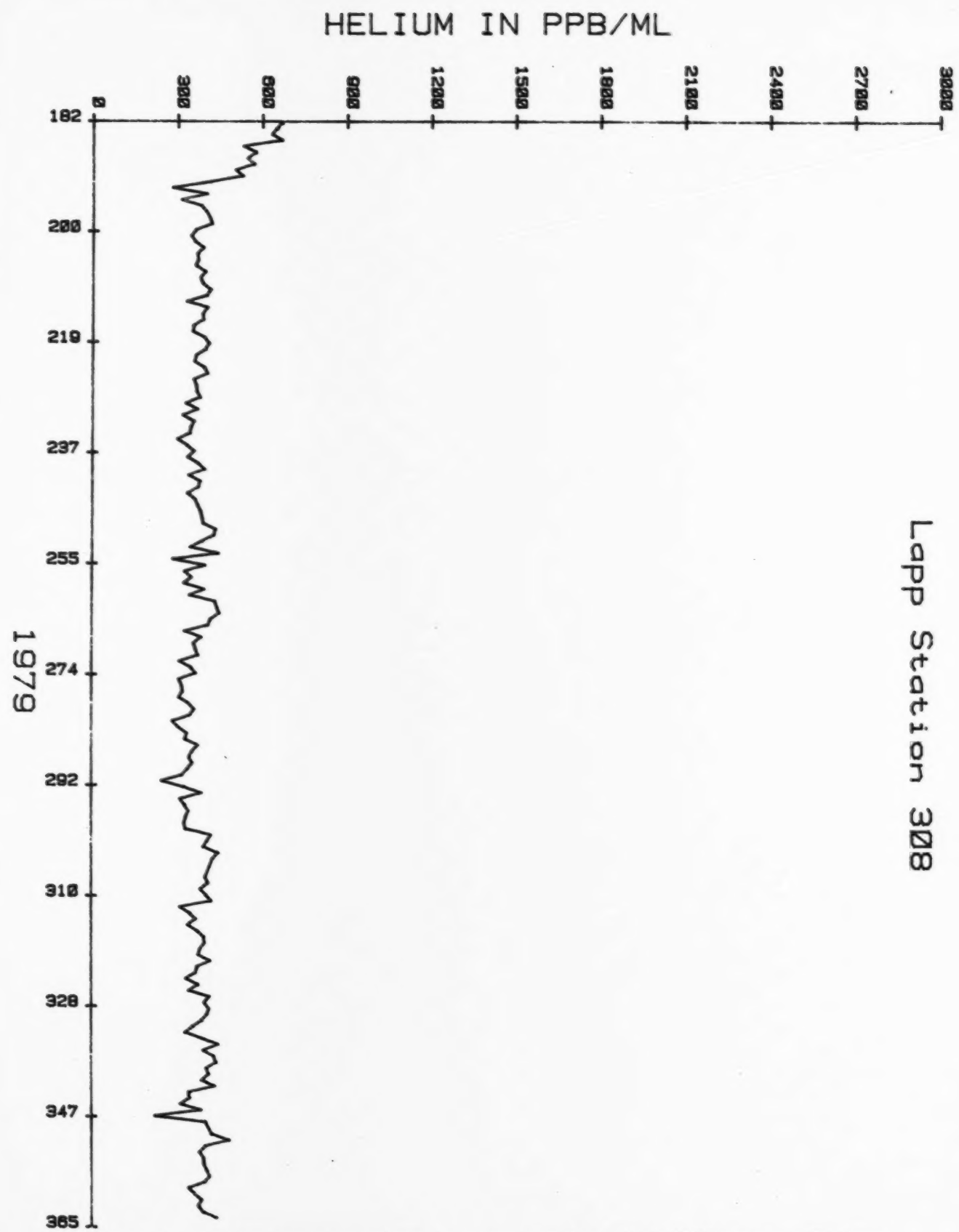

Figure 6.--Helium concentrations in water samples, West Yellowstone, Montana, July through December, 1979.

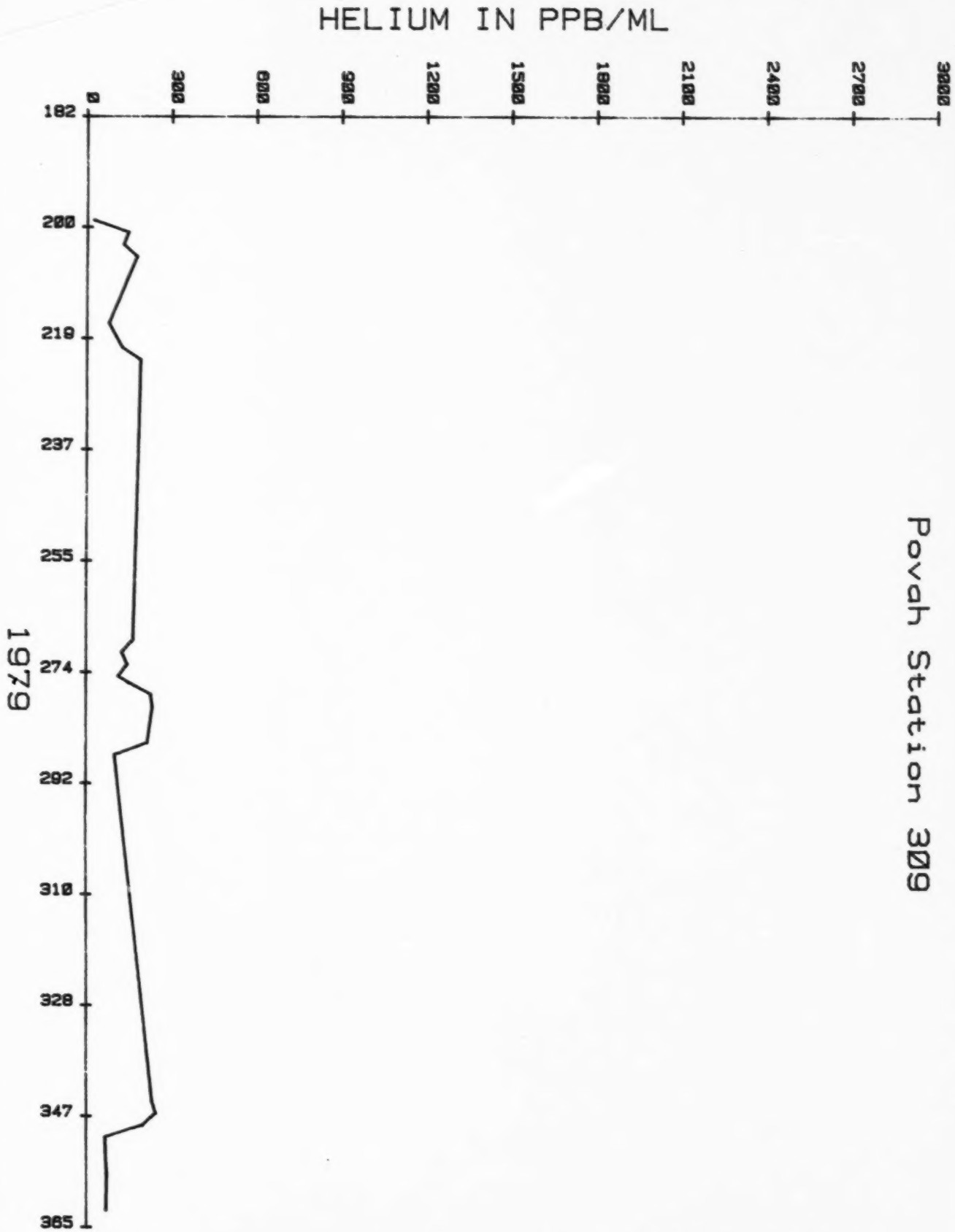

Figure 7.--Helium concentrations in water samples, West Yellowstone, Montana, July through December, 1979.

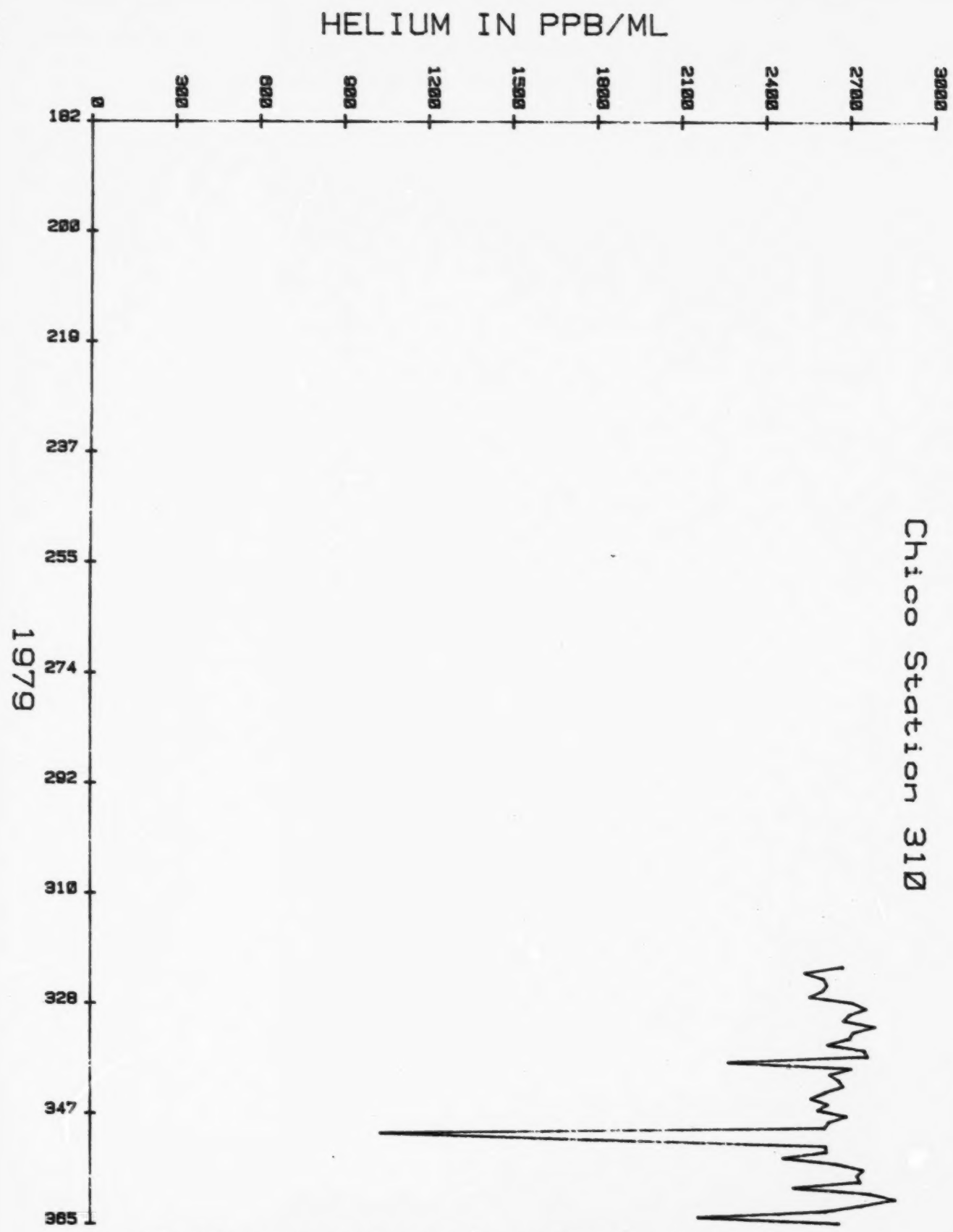

Figure 8.--Helium concentrations in water samples, Pray, Montana, July through December, 1979.

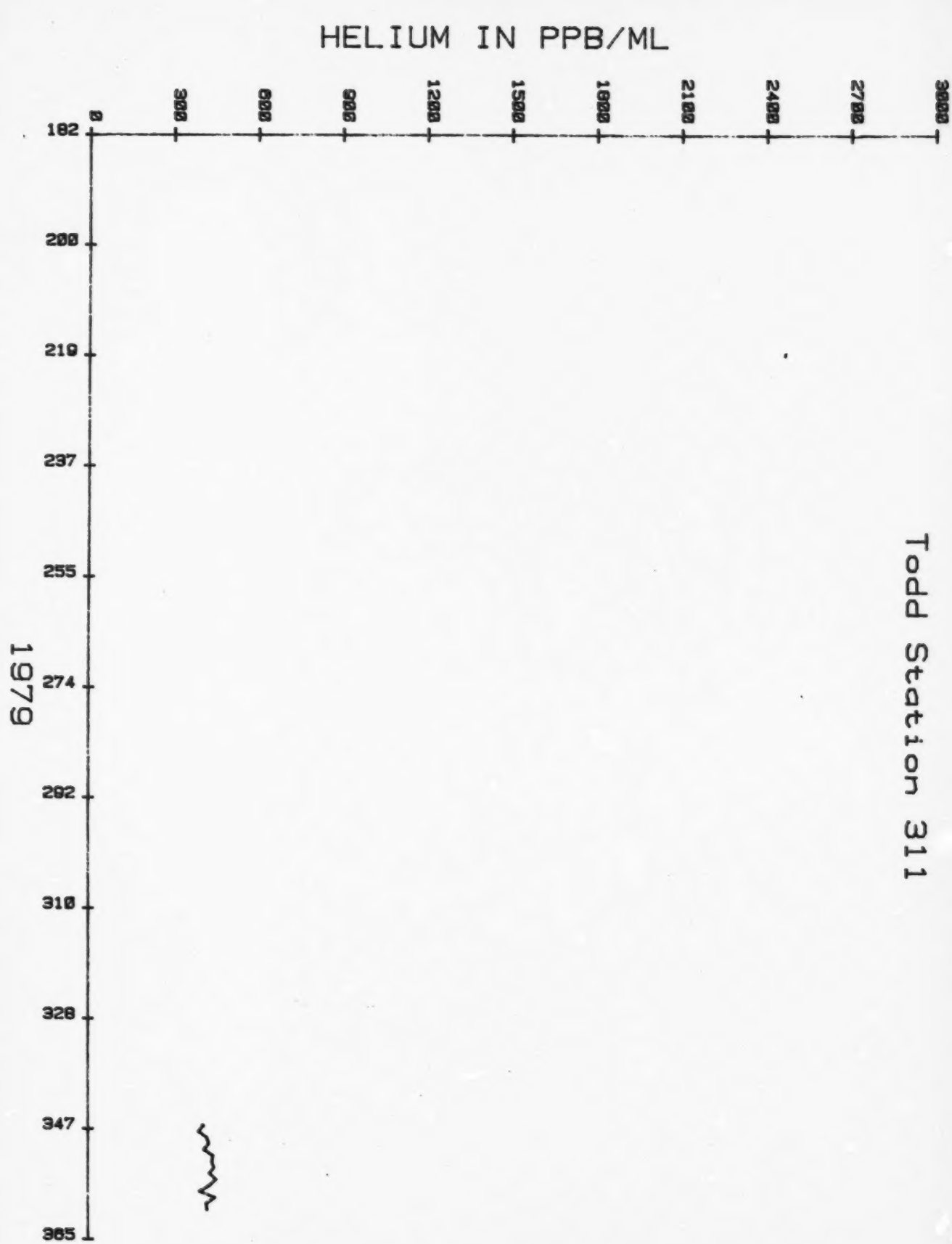

Figure 9.--Helium concentrations in water samples, Emigrant, Montana, July through December, 1979.

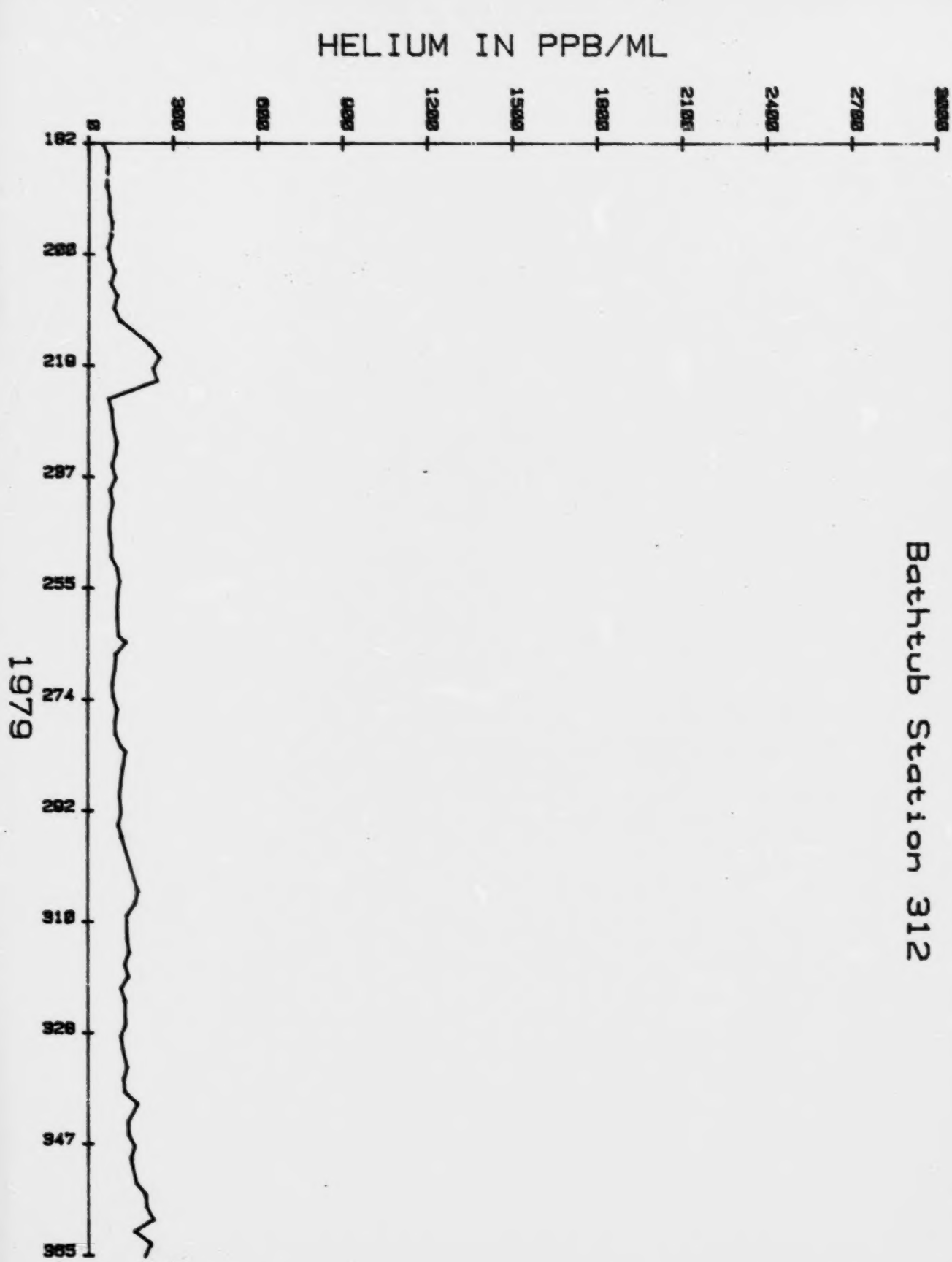

Figure 10.--Helium concentrations in water samples, Yellowstone National Park, Wyoming, July through December, 1979.

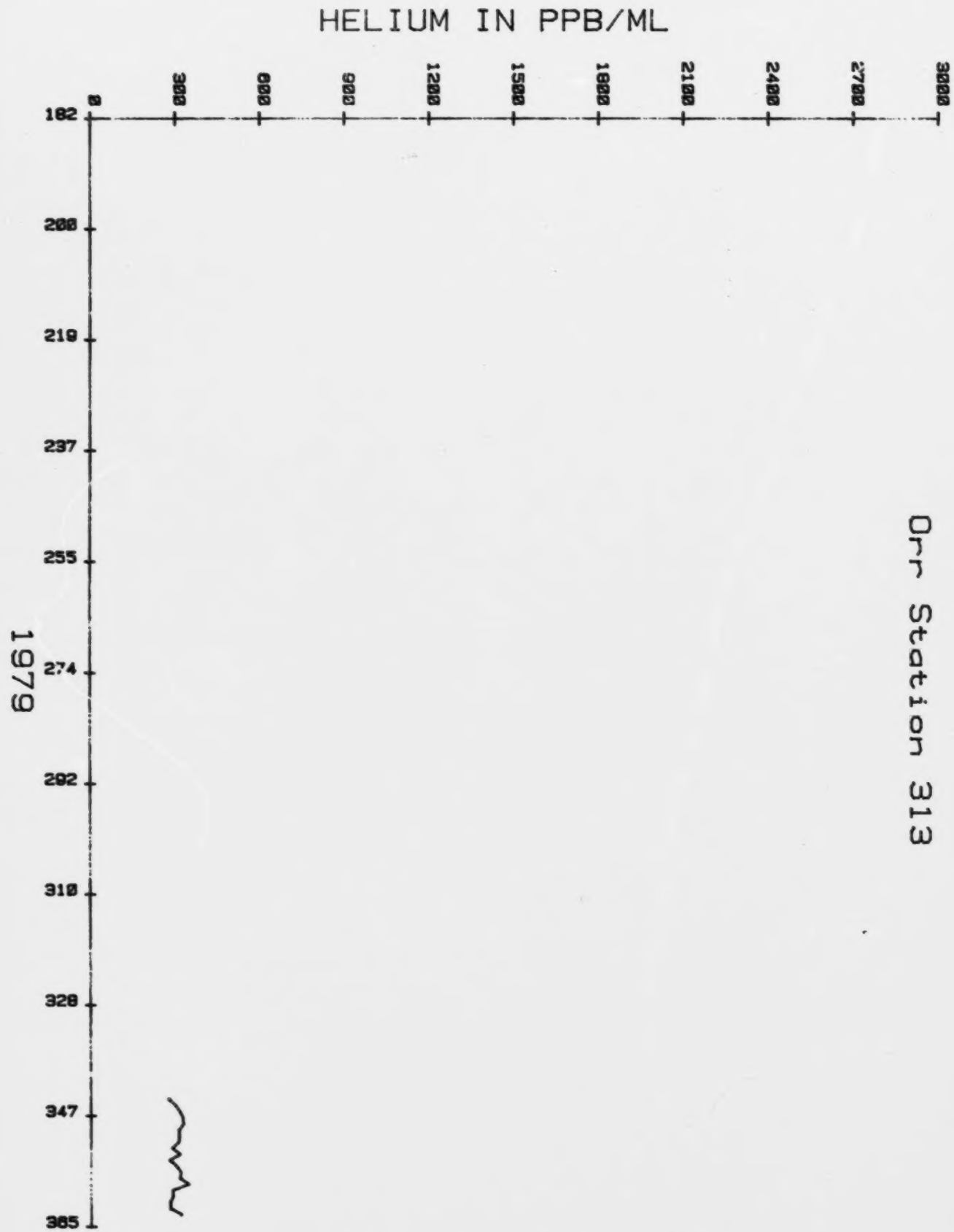

Figure 11.--Helium concentrations in water samples, Ennis, Montana, July through December, 1979.

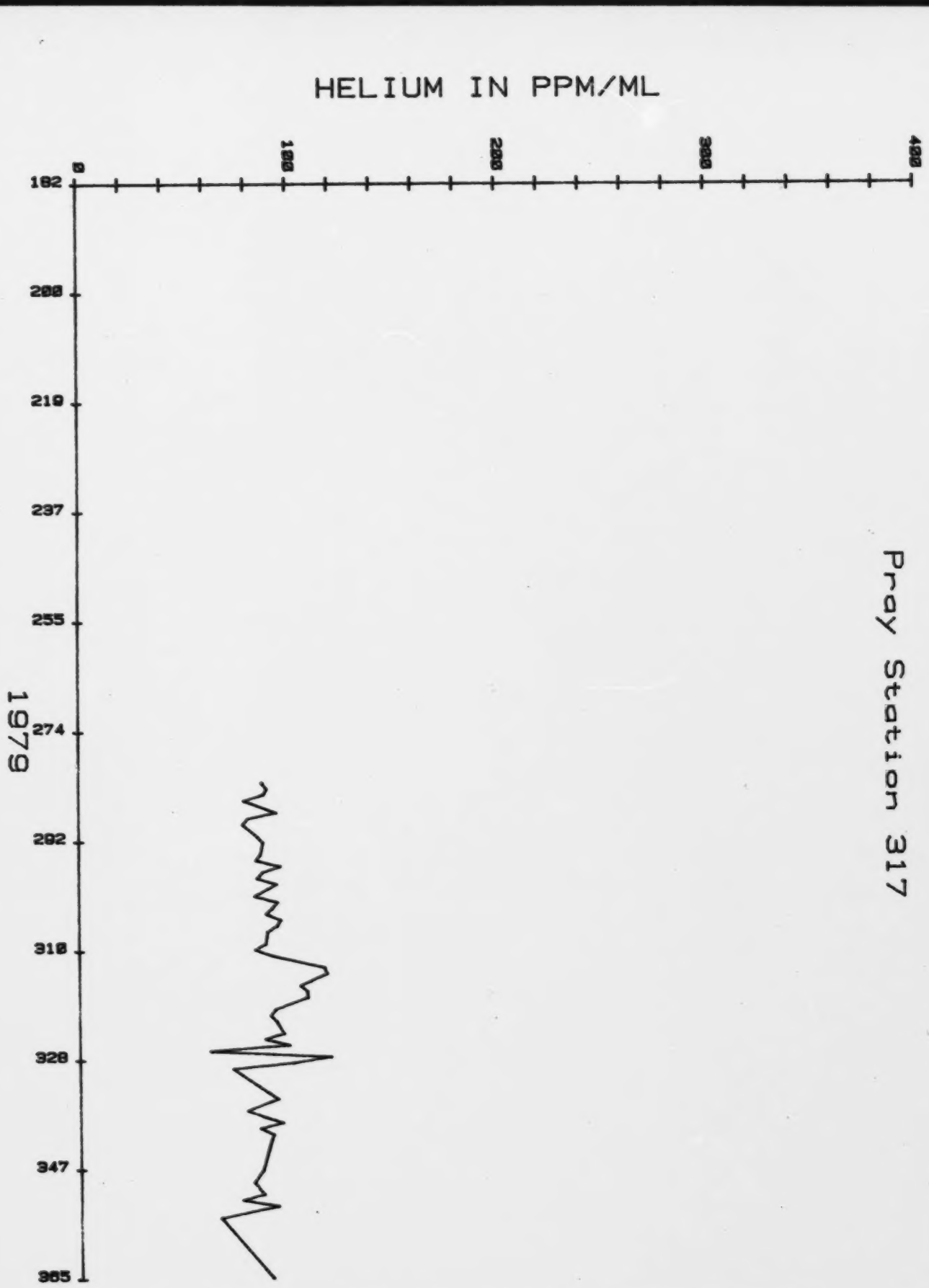

Figure 12.--Helium concentrations in water samples, Ennis, Montana, July through December, 1979.

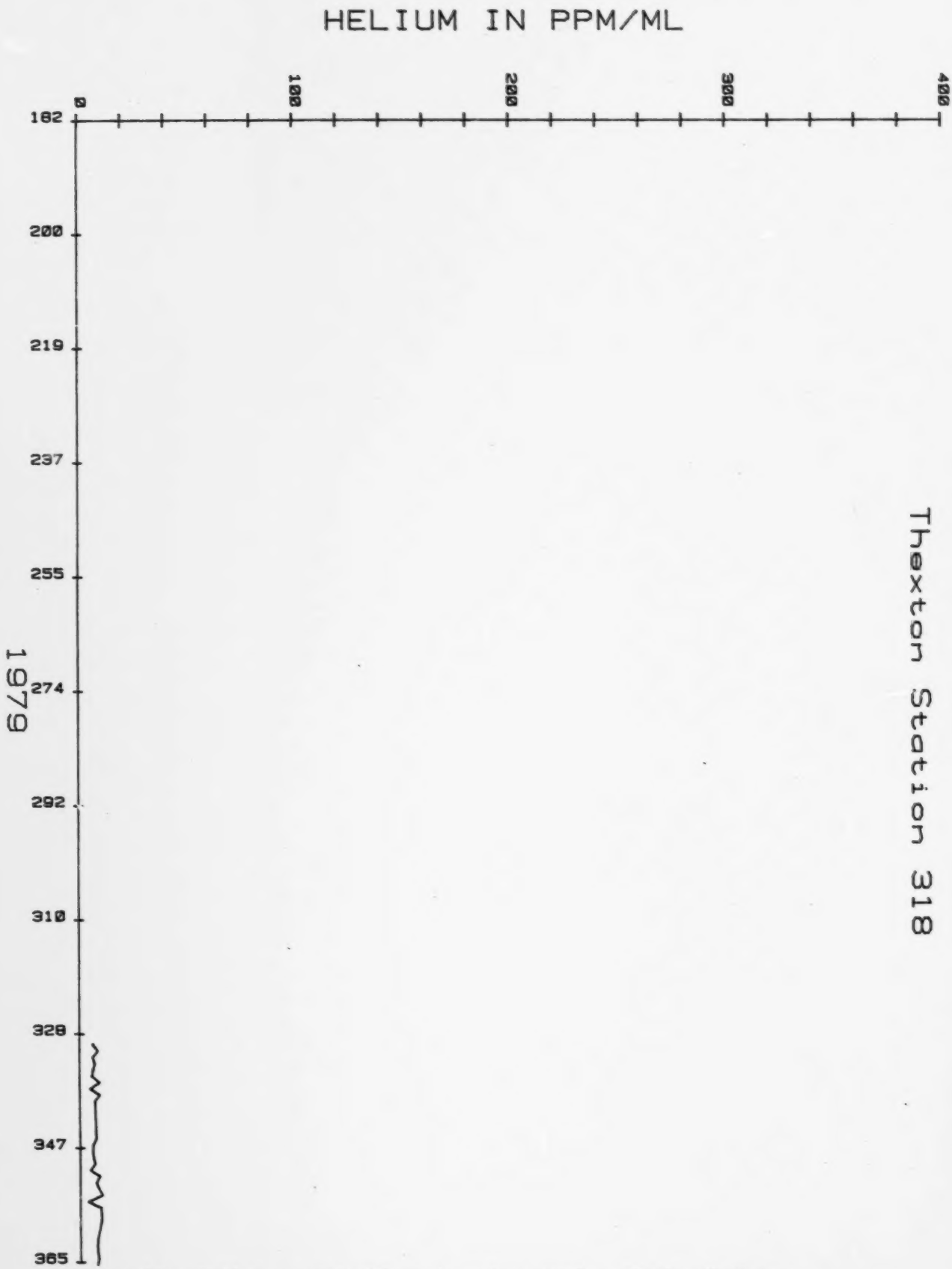

Figure 13.--Helium concentrations in water samples, Ennis, Montana, July through December, 1979.

JULIAN DATE CALENDAR

(PERPETUAL)

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029		088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

Figure 14.--Chart showing correlation of Julian and Gregorian calendar.